CHAPTER 3
STATE AND LOCAL SURVEYS

Several states and one local community have conducted surveys to determine the types and quantities of hazardous materials transported on their highways. Each survey is briefly described in the sections below, and the chapter concludes with a comparison of the survey experiences.

3.1 COLORADO

Colorado Senate Bill (SB) 156, the Hazardous Materials Transportation Act of 1987, was passed in recognition of increasing concern about the potential for serious problems resulting from hazardous materials transportation accidents. One provision of SB 156 directed the State Patrol to designate which Colorado roads can be used for hazardous materials transportation. A truck survey was conducted from December 1987 to May 1988 to learn more about the types and quantities of hazardous materials that were being transported and patterns of hazardous materials movements throughout the state.

Trucks were surveyed at ten sites throughout the state, including selected weigh stations, roadways, and ports of entry. Truck placards were counted, shipping papers were examined, and drivers were interviewed to determine the types and quantities of hazardous materials as well as shipment origin and destination. Ports of entry officers, who deal with trucks on a full-time basis conducted the truck surveys.

Data collected at the survey sites indicated that:

- Ten percent of the shipments surveyed carried hazardous materials, 90% of which consisted of petroleum products.
- Sixty-three percent of the hazardous materials shipments surveyed were flammable and combustible liquids, 27% were flammable gases, 4% were nonflammable gases, 3% were corrosives, 2% were miscellaneous hazardous materials, and 1% were oxidizers.
- Of the hazardous materials shipments surveyed, 52% had both origin and destination within the state, and 45% percent had either origin or destination within the state. Only 3% of the shipments were passing through the state.

Other analyses that were conducted included comparing the placards and interview information over the same 7-day period to identify any differences. In addition, the state looked at accident rates on the highway system. Unlike many other investigations, Colorado looked at accident rates on all roads, not just on those used by truck traffic. This provided an opportunity to contrast accident rates on the routes typically used by trucks to all other traffic accident rates.

Colorado used this information to help identify routes to be designated for hazardous materials transportation. This survey, however, was only one of several methods used to identify hazardous materials routes.

3.2 IDAHO

The goal of this study was to identify factors involving transportation of hazardous materials to determine the health risk to motorists in Idaho. The first phase of the study determined the types and quantities of hazardous material being transported across the state. The second phase assessed the emergency response capabilities of statewide agencies.

The assessment was conducted through surveys of the actual truck traffic on several days during July and August 1987. All trucks at eight ports of entry were counted and, if trucks carried hazardous materials, drivers were interviewed for further information on the types and quantities of materials, shipment origin and destination, driver's training and knowledge of hazardous materials permits and endorsements.

Out of the 11,335 trucks counted, 424 (3.7%) trucks were stopped for interviewing. Hazard placarded trucks ranged from 1.9% to 9.2% of total truck traffic at the different ports of entry surveyed; on average 4% of all trucks on Idaho highways carry hazardous materials, and on average 1% carry a high hazard material, such as radioactive material. Gasoline and other fuel products accounted for the most frequently shipped hazardous materials. Most of the shipments originating outside of Idaho had origins in the neighboring states of Utah, Washington, and California; a majority of the shipments with destinations outside of Idaho were also destined for neighboring states: Montana, Oregon, Washington, and Utah. The highest frequency of hazardous materials traffic occurred on Tuesdays, and peak hours every day occurred between 8:00 a.m. and 3:00 p.m. Fifteen percent of the drivers reported no training for hazardous materials transportation, 12% did not know they needed a hazardous material endorsement, while 25% did not have an endorsement.

Hazardous Material Transportation Monitoring and Capability Study for the Purpose of Assessing Risk to the Public, January 1988 by College of Health Science, Boise State University
Idaho Department of Law Enforcement
Idaho State Police
6050 Corporal Lane
Boise ID 83704
(208) 327-7180

Seventy-nine (74%) of the 107 agencies interviewed responded to the agency inventory questionnaires. Among the major findings were that 33% of the agencies did not have a copy of the State Disaster Plan, 17% of the agencies were unaware of the State Emergency Management System Communication System, and there was general confusion as to who had responsibility for response to any hazardous materials incident in a specific county.

All the data collected was entered into a computer database and given to the Idaho State Police for further study and use. The study concluded that it is apparent from the numbers of hazardous materials shipments occurring each day and the lack of awareness among agencies regarding state hazardous materials response procedures that motorists in Idaho may be at significant risk from a hazardous materials accident. Some agencies have already taken steps to improve their hazardous materials training and response capabilities, and the Idaho Legislature and other agencies are taking steps to improve training and preparedness and ensure that the public is adequately protected from any hazardous materials incidents in Idaho.

3.3 NEVADA

The purpose of the Nevada DOT (NDOT)'s *Nevada Commodity Report* was to present an average day profile of all commodities, including those classified as hazardous materials, being commercially transported via Nevada's highway system. Final results analyzed total truck traffic, and provided a separate analysis of hazardous materials shipments.

Formulas were developed to convert survey numbers to average daily numbers. Factors looked at included an adjusted average daily volume for commercial trucks; each

This information is used to gain further understanding of commodity movement throughout Nevada, both for use in hazardous materials routing as well as for other general highway planning requirements.

Commodity Report
January 1993
Nevada Department of Transportation
Research Division
1263 S. Stewart Street
Carson City, NV 89712
(702) 687-3452

commodity type by vehicle type; and net weight by vehicle type and commodity type.

Hazardous materials tonnages are reported even though the perceived degree of public safety regarding the potential for hazardous materials incidents is more closely related to exposure (frequency) than to the amount (tonnage) of hazardous materials involved. For this reason, the analysis of hazardous materials movements emphasizes frequency rather than tonnage.

There were a total of 45 statewide information collection sites, including 19 points of entry; the routes were divided into 95 "links" to track commodity movement. All drivers of trucks with hazard placards were interviewed, including empty trucks with residual materials; shipments by the Department of Defense are not included because the state does not have the authority to stop these trucks. Drivers were questioned as to points of origin and destination, routes traveled within the state, and details on the specific commodities being transported.

Data were collected in 1989, 1990, and 1992, from a total sample of 19,838 trucks. Results of the study indicated that :

< Hazardous materials trucks accounted for 3.6% of total statewide shipments (3.1% on Interstate routes, 5.2% on U.S. routes, and 6.0% on state routes), and 8.9% of statewide tonnage. Daily tonnage of hazardous materials shipments peaked at 3,489 tons per day on I-15, with a total of 13,576 tons being transported daily throughout the state.

< Of all hazardous materials trucks, 32% were passing through the state, 28% were importing shipments, 22% were exporting shipments, and 18% were intrastate shipments.

< On I-15, the route with the largest hazardous materials traffic, flammable liquids made up 61% of the hazardous materials traffic, corrosives accounted for 18%, and gases accounted for 15%. On all the routes together, flammable liquids made up the largest portion of the hazardous materials traffic, accounting for 50% to 80% of the volume, and up to 86% of the tonnage on any single route.

The collected data were analyzed to determine total numbers as well as percentages of individual commodity shipments and frequency of shipments on different routes. These data were used as background information to assist NDOT in highway planning.

NDOT conducts a similar study every other year, so the information is continually being updated. NDOT is compiling a database of this information; so far the number of trucks surveyed have increased during every survey, but the numbers are expected to begin to level off during the next survey scheduled for 1994. NDOT has not changed its survey methods, except to modify survey locations as indicated by travel patterns.

3.4 OREGON

Hazardous Material Movements on Oregon Highways
1988 by the Public Utility Commission of Oregon
and the Oregon Department of Transportation

A study was conducted in response to the December 1986 recommendations of the Oregon Interagency Hazard Communications Council to quantify the level of risk to the state's citizens. The Council requested the Oregon Department of Transportation (ODOT) and the Public Utility Commission (PUC) to undertake a study to gather information on the types and quantities of hazardous materials transported on Oregon highways, as well as on container types, load origins and destinations, routes traveled, and cities and counties exposed to hazardous materials traffic.

Ten truck weigh scale locations in Oregon and one in Washington were chosen for the survey because they provided facilities for separating hazard-placarded trucks from the general traffic. Five of the survey sites were located on the Interstate system, three were on U.S. (primary) highways, and three

were on Oregon state highways. In conducting the surveys, ODOT and PUC personnel stopped hazard-placarded trucks to examine shipping papers and to gather information regarding routes traveled. Non-placarded trucks carrying Other Regulated Materials were also included in the survey. Information was collected from a total of 2,511 placarded vehicles.

A preliminary survey was conducted in March to determine placard compliance, which was then used to estimate the reliability of data collected from placarded vehicles only. Two-person teams visited each survey site to selectively examine trucks and cargo; 35 vehicles were inspected, and only one placard violation (3%) was found.

The primary surveys were completed in three phases, over a total of 18 days in 1987, consisting of periods that began on a Monday or Tuesday at 12:01 am and continued for 72 hours (3 days). Phase one was conducted during the second and third weeks of March at seven sites outbound from Portland. During phase two, the same seven sites were revisited during the first and second weeks of August to reveal any seasonal differences in truck traffic and hazardous materials shipments. In phase three, during the third week of November, hazardous materials shipments entering Oregon through four border ports of entry were surveyed.

The results of the study indicated that:

< Hazardous materials movements averaged nearly 2 per hour, ranging from 6.4 movements per hour at Woodburn (southbound from Portland) in August, to less than 1 every four hours at Tillamook (westbound from Portland).

< The heaviest total truck traffic consistently occurred at the Interstate survey sites: three locations on I-5 (the main north-south route through Oregon and Washington) and one location on I-84 east out of Portland.

< For the 7 sites surveyed in both March and August, there was a total increase in hazardous materials movements of 44%. The Brightwood location (eastbound from Portland) showed the largest seasonal change in total truck traffic, increasing 50% in August.

< For all the surveys combined, flammables were most common (54%), followed by corrosives (16%) and dangerous shipments (e.g., a combination of flammables and corrosive materials) (6%). There was a noticeable difference in hazard class breakdowns at the four inbound locations: only 38% were flammable, 21% were corrosives, and nearly 16% were dangerous.

< Petroleum products accounted for 30% of all movements, and averaged 6,000 to 9,000 gallons per shipment. By number of shipments, paint was the most commonly imported commodity, accounting for 14% of inbound commodities, ranging from 3,000 to 5,000 pounds per shipment. A large percentage of total movements were hazardous waste, but this was largely attributed to temporary cleanup activities at a nearby Superfund site.

< Of the traffic originating outside of Oregon, 83% originated in the border states: California, Nevada, Washington, and Idaho.

3.5 VIRGINIA

Multi Modal Hazardous Materials Transportation in Virginia describes two surveys, one conducted in 1977 and one in 1978, that were part of a series of six studies undertaken to identify the nature and volume of hazardous materials flows and the associated accident potential for certain transport modes in Virginia.

The 1977 highway study was based on data collected in July and August, from 8 a.m. to 5 p.m. at 38 locations throughout Virginia: ten weigh stations and 28 locations along the Federal-Aid Primary

system. The 1978 study was conducted from April through December on days with two 12-hour shifts, beginning at 7 a.m. at nine weigh stations throughout the state. All trucks were surveyed by examining shipping papers and interviewing drivers. Survey staff for both studies were graduate assistants from the Virginia Polytechnic Institute and State University.

The surveys provided daily estimates of the total number of hazardous materials shipments and the total tonnage of hazardous materials shipped, along with their routing characteristics, for each section of each route on the primary and Interstate systems in Virginia.

The percentage of trucks transporting hazardous materials dropped from approximately 13% in 1977 to approximately 7% in 1978. However, the average load per truck nearly doubled during the same period.

The hazard class breakdowns changed very little between the two studies. In 1977, flammable and combustible liquids, and corrosives accounted for approximately 75% of all hazardous materials transported, of which approximately 64% were flammable and combustible liquids. In 1978, flammable and combustible liquids and corrosives still accounted for approximately 75% of the total, with approximately 62% representing flammable and combustible liquids. Both surveys showed heaviest hazardous materials traffic occurring on the Interstate system, particularly in and around urban areas, although during an average trip, most truck traffic in Virginia uses portions of both the Interstate and primary systems.

Time of day and seasonal variations in hazardous materials flows were determined for the 1978 survey only. Of all the truck traffic, 8% of the trucks carried hazardous materials during daylight hours and nearly 5% transported hazardous materials at night. The percentage of all trucks surveyed transporting hazardous materials was 10% during the spring, 6.2% during the summer, and 7.1% during the fall.

3.6 DALLAS CENTRAL BUSINESS DISTRICT

In 1978, the Dallas City Council amended the city codes to prohibit trucks transporting hazardous material from using depressed and elevated portions of Interstate Highways 30 and 45 near the Dallas Central Business District (CBD) and specified a set of arterial routes to bypass the restricted Interstate segments. As follow-up, Dallas conducted this study to analyze and compare the risks associated with hazardous materials shipments on the restricted highway routes to the designated arterial bypass routes. Concern over the potential for motorists to be trapped in depressed or elevated portions of the highway system during a hazardous materials emergency was a motivating factor for this study.

An initial inventory was conducted by assembling available information from Federal, state and local agencies, including the Dallas Fire, Emergency Preparedness, Streets and Sanitation, and Water Utility Departments, as well as the Texas Department of Water Resources, the U.S. DOT Materials Transportation Bureau (MTB), and the U.S. Environmental Protection Agency. Little of this information was useful due to the regulatory and reporting framework within which it was collected, therefore, Dallas decided to conduct its own data collection activities.

Hazardous Materials Routing Study Phase II:
Analysis of Hazardous Materials Truck Routes in Proximity to the Dallas Central Business District
October 1985

North Central Texas Council of Governments
Regional Information Center
P.O. Box 5888
Arlington TX 76005-5888
(817) 640-3300

Dallas used the FHWA Report *Guidelines for Applying Criteria to Designate Routes for Transporting Hazardous Materials* as a basic framework to design its study. Several enhancements were made to FHWA's risk assessment approach, including modifications to both the risk assessment

algorithm and the information collection regarding the types and quantities of materials being transported.

Three data collection efforts were designed: an inventory of local industries, a visual count of hazard placarded vehicles, and the identification of bulk gasoline storage facilities in the Dallas-Fort Worth area. The inventory sought to identify the types of hazardous materials transported locally, the routes used, and the frequency and time of day for the shipments. An industry survey was sent to 1,400 Dallas and Dallas County industries and transporters that were selected based on SIC code and identified from several information sources, including federal, state, local, and private agencies.

Of the 1,400 industries surveyed, about 300 industries responded; only 100 of these provided detailed information. The majority of bulk shipments are gasoline or petroleum-related, and a number of other materials are regularly being shipped through the area. The data indicated that as many as 25 to 30 9,000-gallon shipments of gasoline travelled in proximity to the Dallas CBD each day.

The vehicle count was designed to complete the picture of local shipments and to establish an estimate of the frequency and types of hazardous materials transported in proximity to downtown Dallas. Six locations for the counts were established surrounding the CBD; all locations were on the freeway system, not on the arterial routes designated by the City Council. Four survey teams of two to three men conducted windshield counts over 10 four-hour periods, all of which occurred on weekdays over several weeks. Counts were completed for 20 hours of a 24-hour period. For about half of the survey time, all trucks passing the survey locations were counted in order to determine the percentage of total truck traffic that was hazardous.

The vehicle counts indicated that hazardous materials account for 5.2% of the total truck traffic, with most shipments occurring during the day. Seventy-four percent of the vehicles recorded were tank trucks; of those, over 70% were carrying gasoline. Most of these counts were consistent with national statistics.

After tallying the data, several sources of information (MTB data, NTSB accident reports, and a DOE report on the risk of transporting gasoline by truck) were reviewed to better understand the causes and results of hazardous materials accidents. These data indicated that a majority of accidents involved flammable liquids (e.g., gasoline), and also that most fatalities or injuries occurred simultaneously with the accident, and thus emergency response actions could have done little to alleviate the fatalities and injuries.

The survey data, the above information, and the fact that the arterial routes selected are more congested with more exposure to the public (e.g., closer to schools, stores, sidewalk traffic) led the Dallas City council to the conclusion that the arterial routes do not decrease the risk to the public, but might actually increase it. Accident probabilities were calculated taking into account potential for tank rupture (perhaps resulting from abrasion), speed, proximity of other motorists, and road geometries; these showed that the highways might actually be safer than the arterial routes. Based upon the data analysis, the city of Dallas has seriously questioned the use of arterial routes for the transportation of hazardous materials and would continue to reevaluate their routing plans. Also, safety, training, inspection, enforcement and other programs are being considered to reduce potential risks to motorists and the public.

3.7 COMPARING SURVEY EXPERIENCES

As described above, several states and at least one major metropolitan area conducted highway hazardous materials flow studies of varying complexity. However, all of these studies were designed to provide specific and reliable information that was previously unavailable or difficult to assemble for decision-making purposes. Because this objective was achieved to an acceptable degree, the survey procedures adopted, with emphasis on key elements of survey design, are discussed below.

All surveys reviewed, with the exception of those in Dallas-Ft. Worth, Nevada, and possibly Idaho, were conducted in ways that revealed important daily and seasonal fluctuations in hazardous materials flows. On average, those surveys spanned eight, but not necessarily consecutive, calendar months and at least two seasons. Oregon's survey (three days of continuous sampling during different seasons) was probably successful in establishing whether fluctuations in flows exist. But the selection of survey sites in Oregon may not be a good model for other states whose objectives encompass a broader (i.e., statewide) base of inquiry. Seven of the ten Oregon survey sites were within 100 miles of the Portland metropolitan area, primarily because flows into and out of Portland were the study's primary focus. It would not therefore be appropriate to term Oregon's survey a statewide effort. Similarly, results of the Dallas/Ft. Worth survey should neither be applied statewide nor necessarily considered representative of other major metropolitan areas in Texas.

Data from the Virginia survey were more comprehensive than Oregon's and likely to include late-week and weekend activity that Oregon would have missed. However, the Oregon interviewers may have observed more about individual trucks and shipments because of their relevant professional experience and because of the selective truck inspections conducted.

Exhibit 14 summarizes the results of five of these hazardous truck traffic studies with respect to the surveyed distribution of hazardous commodities by type and compares these results to the distribution of highway hazardous materials transportation accidents by hazardous materials type in each state for:

- The two-year period 1989-90 based on data reported to DOT/RSPA Hazardous Material Information Reporting System (HMIS); and

- The two-year period 1987-88 from the DOT/OMC 50-T Master File of Accidents of Motor Carriers of Property.

The exhibit shows that considerable insight can be gained from these databases prior to planning and conducting a flow study. Even though the HMIS and OMC 50-T data are compiled from transportation accidents, rather than flows, distribution of incidents in some cases closely parallels the revealed survey share of commodity flow within both state of occurrence and hazardous materials class.

EXHIBIT 14
COMPARISON OF FINDINGS OF FIVE TRUCK TRAFFIC SURVEYS AND STATISTICS FROM PUBLIC USE FEDERAL DATA BASES

State/Hazardous Material	Hazardous Materials Movement as Percent of Total Truck Traffic (or Accidents) in:		Hazardous Materials Traffic (or Accident) Breakdown in Percent	
	State Survey	50-T	State Survey	HMIS
Colorado	**10.0**	**6.2**		
Flammable & Combustible Liquids			63	53
Flammable Gases			27	1
Nonflammable Gases			4	0.4
Corrosives			3	29
Oxidizers			1	3
Idaho	**4-6.0**	**4.5**		
(Results based on ten or more shipments by commodity type)				
Flammable & Combustible Liquids			29	59
Corrosives			10	13
Oxidizers			4	13
Other Regulated Materials, Class E			4	13
Nevada	**8.0**	**9.3**		
Flammable Liquids			59	36
Gases			7	2
Corrosives			22	31
Oxidizers & Organic Peroxides			2	4
Explosives			2	4
Poisonous & Etiologic Materials			1	3
Oregon	**5.5**	**3.4**		
Flammable & Combustible Liquids			54	39
Flammables Gases			4	2
Nonflammable Gases			6	2
Corrosives			16	31
Other Regulated Materials			9	12
Virginia (av. of 2 years)	**10.0**	**3.9**		
Flammable & Combustible Liquids			64	55
Flammable Gases			7	1
Nonflammable Gases			6	5
Corrosives			12	27
Oxidizers			1	2
Organic Peroxides			0.3	1
Explosives, Class B			1	1
Poisons, Class B			1	4
Radioactive Materials			1	1
Other Regulated Materials, Class A			0.5	4
Other Regulated Materials, Class C			2	1

CHAPTER 4
CASE STUDY EXAMPLE

To conclude this guidance, this chapter presents a hypothetical example of how a state designed and carried out a study and the conclusions they reached following the step-wise guidance presented in Chapter 2. The user of this guidance can also consult Chapter 3 for examples of studies that have actually been carried out.

4.1 IDENTIFY PURPOSE OF STUDY

State officials know that several counties lie along a well traveled highway corridor between a major benzene plant and a petroleum refinery complex at which large volumes of premium-grade gasoline are produced. They need to determine whether the quantity of benzene and other aromatic hydrocarbons shipped through the counties warrants new emergency response training for local fire and public safety agencies or whether a state emergency response team headquartered nearby has adequate response capability. To answer the above questions, a flow study is planned at survey locations on the two major highways serving the shipping corridor.

4.2 ASSEMBLE EXISTING INFORMATION

Prior to undertaking the actual survey, available data are examined for possible insights into the flow pattern as it exists. Count data from a Highway Performance Monitoring System (HPMS) surveillance point on the most-travelled (>13,500 vehicles/day) of the two highways indicates a heavy combination truck volume of 6.3 percent in spring and 6.7 percent in autumn, or between 850 and 900 large trucks per average weekday. Expanded to the entire corridor, this estimate could approach 1,600 trucks. The Hazardous Materials Information System (HMIS) data base for 1985-90 shows that four incidents involving hazardous materials releases occurred during truck hauls from the community containing benzene plant to the refinery complex site; all but one involved aromatic hydrocarbons. This statistic is generally consistent with records of the Office of Motor Carriers 50-T database (historically available, but now superseded by the Safety Net database, see page 8) for the same period, although one of the incidents included in the HMIS apparently did not meet the damage threshold for reporting to the DOT Office of Motor Carriers, and another did not involve an interstate-registered carrier. The 50-T indicates that 12 percent of interstate-registered heavy combination truck accidents reported in that corridor from 1985 through 1990 involved at least one vehicle carrying hazardous cargo. Assuming that accidents by cargo type are proportional to flows by cargo type, upwards of 200 trucks per day could be hauling hazmats through the corridor.

The State Highway Division follows up with each of the carriers involved in the HMIS incidents to a) verify shipment origin, destination, and location of incident, and b) confirm the nature and cause of the release. The carriers are also asked about how many hazardous shipments per year they handle between the benzene plant and the refineries; two of the three carriers provide complete shipment records for the relevant consignments that cover the year just preceding (the third carrier provides a rough estimate). Finally, the LEPC provides inventories of hazardous materials stored on site submitted to them by the refinery operators under SARA Title III. The quantity of aromatic hydrocarbons available at any one time at the refineries represents about 20 percent of the monthly production capacity of the benzene plant; thus, it is *possible* that the plant is supplying up to 100 percent of the refineries' collective benzene requirements.

4.3 DESIGN STUDY

Survey stations are established at four locations, one near each end of the two corridor routes. For two of the four locations, existing weigh station facilities are available. The other two are set up 1) adjacent to a freeway rest area and 2) by a large restaurant/service station facility catering primarily to truckers. Truck traffic is sampled for sixteen hours a day (6 a.m. to 12 a.m.) in two working shifts over two-week periods in early spring and mid-autumn.

4.4 CONDUCT STUDY

A total of 13,986 (non-duplicate) trucks are surveyed in the spring and 14,777 in the autumn; based on HPMS data, this is believed to represent better than a 60 percent (three-fifths) sample of all truck movements

during each recording period. Survey data are processed such that they can be sorted, tabulated or summed on any variable. Results of this (hypothetical) survey are summarized in Exhibit 14.

4.5 ANALYZE RESULTS

Based on the count results only, the Highway Division can interpolate the values in Exhibit 15 to be 99% confident that the survey may have missed as many as 44 trucks carrying combustible liquids during the spring survey period, or over-represented the typical bi-weekly spring flow of such combustibles by as many as 38 trucks. Other confidence ranges by hazmat class are similarly computed.

Although the limited routing data collected from truckers clearly indicate a strong linkage between the benzene producer and the refinery complex, the total volumes of aromatics shipped are not especially high. However, important seasonal and time-of-week variations in the number of shipments are revealed by the survey. Larger quantities of benzene are shipped in the spring than in the fall, as the refineries gear up to produce enough gasoline to meet peak summertime demand. In the autumn, more distillate oil production for winter heating significantly reduces benzene shipments and quantities. Moreover, more benzene is shipped on Mondays, Tuesdays, and Fridays (apparently to accommodate refinery production schedules) than on Wednesdays, Thursdays, and weekends. About 30 percent of this movement is taking place during the nighttime hours.

An unexpected survey finding is that large volumes of highly corrosive metal-processing waste generated in a neighboring state are being shipped along the corridor for disposal in another state. The hazardous waste facility in that state to which the effluent had been sent for disposal for the past 20 years was now closed, creating the need to move the waste much greater distances for disposal.

4.6 APPLY RESULTS TO PURPOSE

On the basis of their analysis of the flow data, the state officials determine that additional preparedness training for an emergency involving aromatics is not needed at the local level. However, additional capabilities and procedures for off-hours notification of the state's hazmat team need to be installed in all local emergency response vehicles and departments in the corridor. The state officials also adjust their estimate of delay between the time of occurrence of a benzene transportation emergency and the hazmat team's arrival at the scene. Its former "worst case" (i.e., late night hours) is now a "probable case." In addition, they decide to increase inventories of chemical neutralizing agents, surfactants, and foams at fire departments throughout the affected counties.

EXHIBIT 15
RESULTS OF HYPOTHETICAL TRUCK TRAFFIC SURVEY

Daily weekday total traffic in corridor from HPMS and state surveillance counts:
SPRING--24,600 AUTUMN--25,200
(Extrapolated) share of traffic that is combination trucks:
SPRING--6.3% AUTUMN--6.7%
Share of heavy truck volume 6 a.m.-12 a.m.:
SPRING--89% AUTUMN--84%
Computed total heavy truck flow during survey period (weekend days = 1/2 weekday):

SPRING: (24,600)(.063)(12)/(0.89) = 20,896; 13,986/20,896 = 0.67
AUTUMN: (25,200)(.067)(12)/(0.84) = 24,120; 14,777/24,120 = 0.61

Truck Traffic

		in State Survey			
		Spring	*Fall*	*Spring*	*Fall*
	Percent Hazardous Materials Movement	**20.3**	**16.2**		
Class or Division Number	**Description of Hazardous Material**	**Percent**		**Count of Hazmat Traffic Surveyed**	
3	Flammable and Combustible Liquid	60	55	1,704	1,317
2.1	Flammable Gas	14	6	397	144
	Aromatics	*11*	*4*	*312*	*96*
	Non-aromatics	*3*	*2*	*8*	*48*
2.2	Nonflammable Gas	3	5	85	120
8	Corrosive Material	19	24	539	575
5.1	Oxidizers	1	2	28	49
5.2	Organic Peroxide	0.2	1	6	23
1.3	Explosives (with predominately a fire hazard)	0.4	0.3	11	7
6.1	Poisonous Material	1.3	1.5	37	34
7	Radioactive Material	0.8	2.6	23	63
None	Other Regulated Materials-D	0.3	2.6	9	62
	TOTAL	100%	100%	2,839	2,394